CHAPTER 3

SURFACE OBSERVATION CODES

INTRODUCTION

The World Meteorological Organization (WMO) is an international organization located in Geneva, Switzerland. Operating as part of the United Nations, its purpose is to provide international exchange of meteorological, oceanographic, and geophysical data and to conduct research in these areas. Most members of the United Nations are also members of the WMO, and have agreed to an international exchange of data in code forms specified by the WMO. These codes are used throughout the world and are known as the *WMO International Codes.* International codes have been established for reporting surface weather conditions, aviation weather conditions, upper atmospheric conditions, climatic conditions, oceanographic conditions, earthquakes, and volcanic activity. In this chapter, we will discuss weather logs for recording observations, the applicable reference sources, and the four surface observation codes. Now let's take a closer look at the WMO regions and code forms.

WMO REGIONS AND CODE FORMS

LEARNING OBJECTIVES: Recognize the seven WMO regions. Distinguish between the various regional and national codes. Identify the four different code forms used by weather observers. Identify the primary references for weather observations used by Navy and Marine Corps personnel.

The WMO has divided the world into the following seven regions:

- Region I - Africa
- Region II - Asia
- Region III - South America
- Region IV - North and Central America
- Region V - South-west Pacific
- Region VI - Europe
- Region VII - Antarctic

Within each region, certain codes are used that are not used in any other region. These codes are called "Regional codes." When information is included in these codes that does not conform to international code formats, the format difference is called a "Regional coding practice."

Many countries are contained in each WMO region. When a particular country elects to report additional information in an International code that does not conform to either the Regional coding practice or to the International code format, it is known as a "National coding practice." Similarly, when a particular country chooses not to use an International code but reports conditions by using their own code, the code is known as a "National code form."

The WMO International codes are explained in detail in WMO Publication 306, Manual on Codes, Volume I, *International Codes.* This publication has been republished by Commander, Naval Meteorology and Oceanography Command (CNMOC) as NAVAIR 50-lP-11. (See appendix IV, WMO Code Tables.) A more complete listing of regional and national coding practices is contained in WMO Publication 306, Manual on Codes, Volume II, *Regional Codes and National Coding Practices.* Both publications have been distributed to all Navy and Marine Corps observation sites.

Weather observers throughout the world record and report surface weather observations in four different international code forms. The four code forms are

- METAR Code;
- SPECI Code;
- Land Synoptic Code; and
- Ship Synoptic Code.

A modified version of the METAR and SPECI code is used by federal agencies in the United States. Surface *Weather Observations and Reports,* Federal Meteorological Handbook No. 1 (FMH-1) is a publication developed by the National Oceanic and Atmospheric Administration (NOAA) for use by the National Weather Service. It contains detailed instructions for the METAR and SPECI codes as used in

the United States. Other federal agencies may develop their own observing handbooks. However, they must comply with the basic standards set forth in FMH-1.

A slightly more modified version of the METAR/SPECI codes has been developed for use by Navy and Marine Corps activities. The primary reference manuals outlining these procedures are NAVMETOCCOMINST 3141.2, *Surface METAR Observations User's Manual,* used by shore activities, and NAVMETOCCOMINST 3144.1, *United States Navy Manual for Ship's Surface Weather Observations,* used by shipboard observers. These provide detailed instructions on recording and encoding observed surface aviation weather observations using the METAR/SPECI format.

Before we discuss the different codes, let's take a closer look at the forms used to record observations and how these observation records are handled and archived.

REVIEW QUESTIONS

Q1. What does the acronym WMO mean?

Q2. The United States is located in what WMO region?

Q3. What are the four code forms used by Navy weather observers?

Q4. What instruction governs weather observation procedures at Navy and Marine Corps shore stations?

Q5. What instruction governs weather observation procedures for U.S. Navy ships?

OBSERVATION RECORDS

LEARNING OBJECTIVES: Describe the forms used to record weather observations. State the primary purpose of collecting accurate weather data. Explain three methods used to correct observation forms. Describe how observation records are maintained and archived.

Throughout the Navy and Marine Corps, observations are recorded on weather observation forms, also known as weather logs. These observation forms are permanent official records. At shore stations, observations are recorded on CNMOC Form 3140/12. See figure 3-1. This is a modified version of the Federal Meteorological Form 1-10 used by the National Weather Service. Shipboard observations are recorded on CNMOC Form 314113 (fig. 3-2). The data columns on the forms are generally identified by a column number in parenthesis, and the columns are generally arranged in numerical sequence. There are also sections for recording synoptic data, hourly and daily summaries, and runway condition summaries. A complete discussion of the actual recording of observation elements and the precision required will not be discussed here. Refer to either NAVMETOCCOMINST 3141.2 or NAVMETOCCOMINST 3144.1

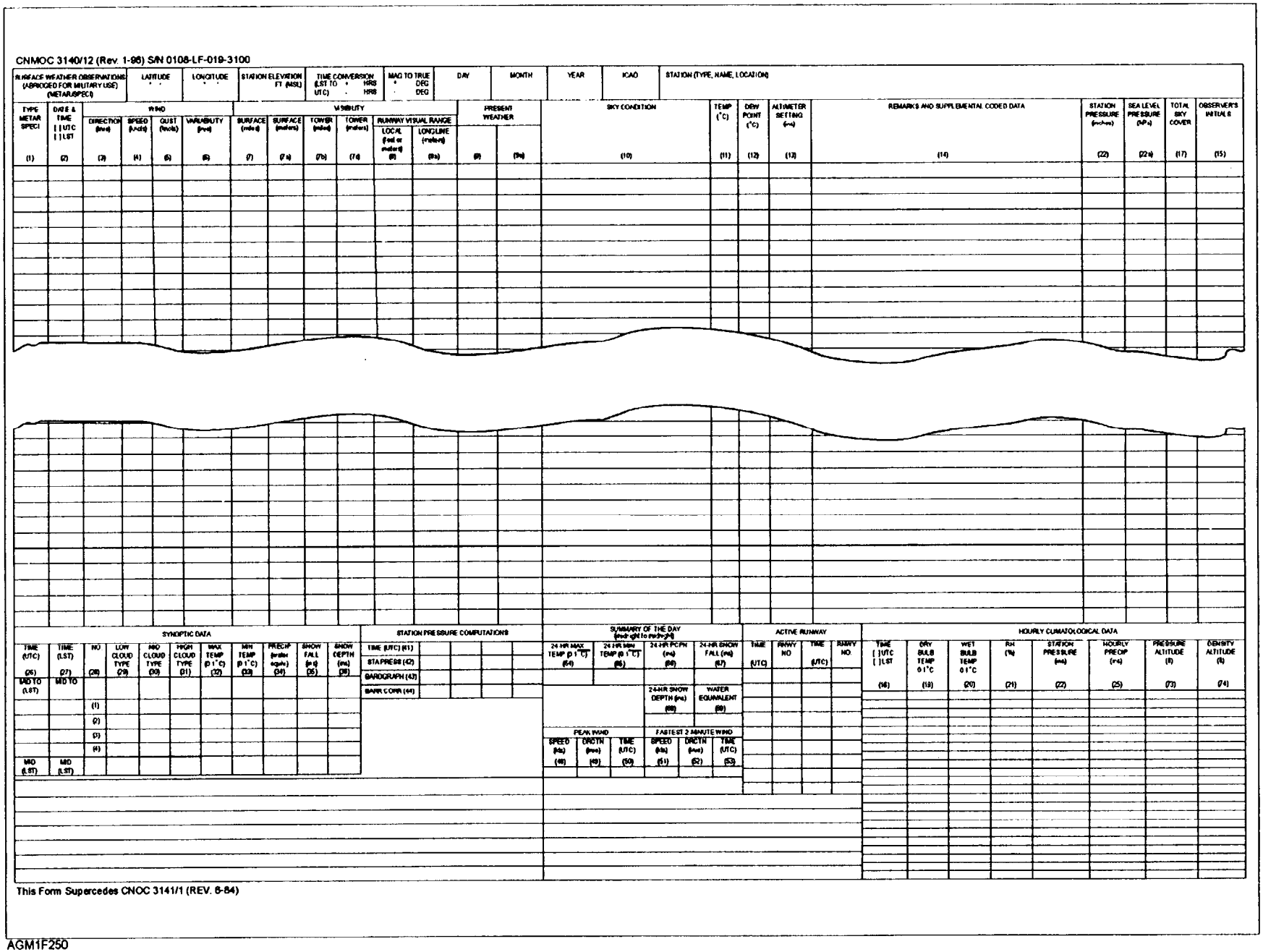
FORM ENTRIES

METAR/SPECI aviation weather observations are recorded on the observation forms previously discussed. Entries should be neat and legible, and only a pencil with black, grade 2, medium lead or a 0.5 mm mechanical pencil with black lead should be used. Missing data is indicated by an "M" in the appropriate column. In the block labeled "STATION," enter the type (NAVLANTMETOC DET, NAVPACMETOCCEN, etc.), the official station name, and the state or country abbreviation. Also enter the latitude, longitude, station elevation, time conversion (LST to UTC), magnetic to true conversion, the date, and the ICAO call sign.

Only observers certified in accordance with NAVMETOCCOMINST *1500.2, Naval Meteorology and Oceanography Command Training and Certification Program, can* make entries on the form. Noncertified observers may make entries on the form under the immediate supervision of a certified observer. The certified observer will then assume responsibility for the validity of the entries by initialing in Column 15. Noncertified observers may initial the observation, but the certified observer must initial first.

CORRECTIONS TO OBSERVATION FORMS

The primary purpose of collecting and transmitting weather data is the safety of aircraft, ships, and personnel. Therefore, you must make every effort to ensure that data is entered correctly. At times, even the best observer will make an error, but you should make every effort to detect errors before the data is distributed. When an error is discovered, a corrected observation should be transmitted as soon as possible.



This Form Supercedes CNOC 3141/1 (REV. 6-84)

AGM1F250

Figure 3-1.—CNMOC Form 3140/12, surface weather observations (shore station).

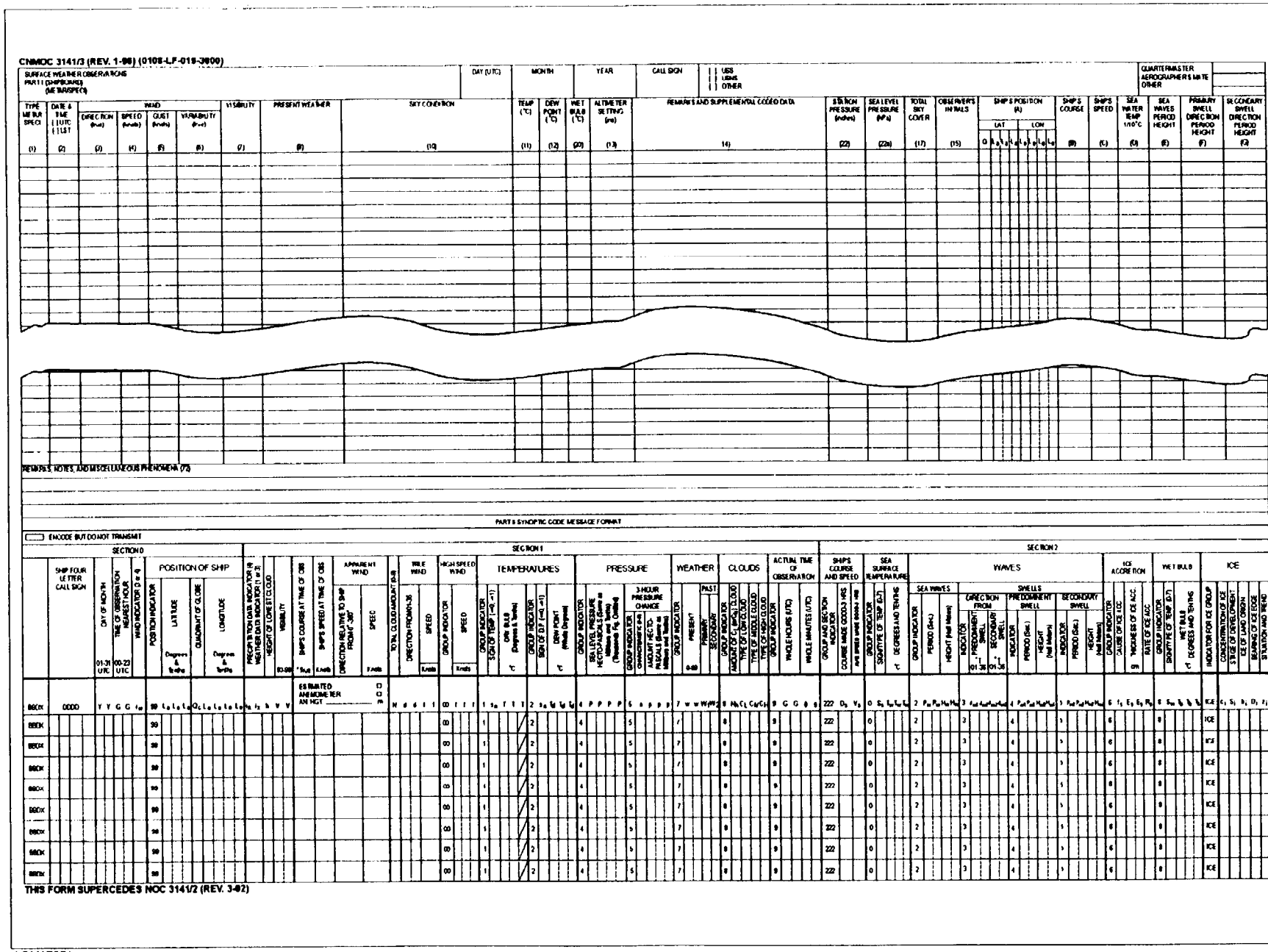


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Figure 3-2.—CNMOC Form 3141/3, surface weather observations (shipboard).

Since all observations are entered into the climatic data base, errors on the observation form should be corrected even if discovered too late to provide timely and accurate information to aircraft and ships. You should correct errors in the following three ways:

- If an error has not been transmitted, erase and reenter data correctly.
- If an error is discovered after transmission, line out the error, enter the correction in red, transmit the correct data, and then enter the *correction time*, which is the time of transmission of the corrected data.
- If an error has been transmitted but superseded with a later observation, simply line out and enter the correction in red.

See NAVMETOCCOMINST 3141.2 or NAVMETOCCOMINST 3144.1 for additional details on entering corrected data. To help reduce errors, all data should be reviewed by another qualified observer. Most sites have an established quality control person who routinely reviews the observation forms. Other than the observer, the quality control person is the only individual who may be authorized to make corrections to an observation record.

MAILING OF RECORDS

At the end of each month, the original observation forms are forwarded to the Fleet Numerical Meteorology and Oceanography Detachment, Asheville, North Carolina. Refer to NAVMETOCCOMINST 3141.2 or NAVMETOCCOMINST 3144.1 for detailed information on mailing observation forms. Additional information is also contained in NAVMETOCCOMINST 3140.1, *U.S. Navy Meteorological and Oceanographic Support System Manual*, and FNMODASHEVILLENOTE 3140, *Procedures for Submitting Meteorological Records.* The observation forms are microfiched at Asheville, and the information is included in the National Climatic Records data base. Duplicate copies of the observation forms may be retained on board until no longer needed; however, most sites retain the duplicate copies for at least 1 year.

After recording the observation, it must be encoded for local and/or longline (regional or national) dissemination. In the next section, we will discuss the codes used for dissemination purposes.

REVIEW QUESTIONS

Q6. How should missing data be indicated on observation forms?

Q7. What is the primary purpose of collecting and transmitting weather data?

Q8. How is an observation error corrected on an observation form after the observation has been transmitted?

Q9. Where are observation forms mailed at the end of each month?

SURFACE AVIATION WEATHER – METAR/SPECI CODE

LEARNING OBJECTIVES: Identify the applications of the format of the METAR and SPECI codes. Describe the elements of the METAR and SPECI codes and define the meaning of each element.

The METAR code is an International Observation code used to record and disseminate routine surface aviation weather observations. The SPECI code is a related International code used to record and disseminate selected surface aviation weather observations marking significant changes in the weather conditions. It is used to supplement the hourly observations in the METAR code.

The METAR and SPECI codes discussed in this section are used by all Navy and Marine Corps activities worldwide and are a modified version of the WMO METAR and SPECI codes used by most of the other countries in the world.

As previously mentioned, the primary reference manuals for Navy and Marine Corps activities are NAVMETOCCOMINST 3141.2 and NAVMETOCCOMINST 3144.1. You, as an observer, must be thoroughly familiar with these instructions. We will now discuss the encoding of the individual elements of a METAR observation.

TYPES OF OBSERVATIONS

In METAR, there are only two types of observations:

- Routine observations (METAR)—routine observations, taken each hour on the hour. The observation time is noted when the last element was

observed and must be within 5 minutes before the scheduled observation hour.

- Special observations (SPECI)—observations taken to note any significant change in the weather as defined by NAVMETOCCOMINST 3141.2 and NAVMETOCCOMINST 3144.1. The observation time is the time that the significant weather element is observed. SPECI observations are also used in the event of an aircraft mishap, volcanic eruptions, and any other phenomena designated by local authority.

While METAR observations contain complete observation data, SPECI observations usually contain data pertinent only to the significant event or local requirement. Table II-1-1 of NAVMETOCCOMINST 3141.2 and table 2-1 of NAVMETOCCOMINST 3144.1 list which elements are reported for each type of observation.

BASIC CODE FORM

The METAR code contains both a basic report section and a supplemental or additive data section, as shown in table 3-1. In addition, remarks may be coded or in plain language. By regional decision, coded additive data groups may be added to the reports. Any missing elements are simply left out of the report. Keep in mind there are minor code differences between reporting stations in the United States and activities located outside of the continental United States (OCONUS).

BASIC METAR CODED REPORT

The basic coded METAR report contains identification data, wind, visibility, weather, sky coverage, temperature, dew-point temperature, and altimeter setting.

Identification Data

Identification data in a METAR or a SPECI observation consists of the observation type (METAR or SPECI), the station identifier, and the observation time.

ICAO STATION IDENTIFIER.—CCCC. The first letter indicates the country, while the remaining three letters identify the actual station. These identifiers are designated by the International Civil Aviation Organization (ICAO) and are used to identify each aviation terminal, including military stations. A list of approved identifiers can be found in FAA Order 7350.6, *Location Identifiers.*

UTC TIME.—YYGGggZ. METAR observations are identified with the date and actual time of the observation in UTC time. SPECI observations are identified with the time that the SPECI observation criteria was met. *YY* is the day, *GG* is the hours, and *gg* is the minutes (00 in a METAR observation, the actual time in minutes for a SPECI observation). *Z* is the indicator for UTC time. The date is not recorded on either observation form but is for dissemination purposes only.

Report Modifiers

A report modifier may or may not appear in the report. The report modifier AUTO is used by automated stations. The report modifier COR indicates the report was retransmitted with corrected data. Use the same time as the original report.

Table 3-1.—METAR and SPECI Code Format

SYMBOLIC FORMAT OF METAR/SPECI CODES:	Basic Reporting Code
METAR or **SPECI** CCCC YYGGgg**Z** AUTO/COR dddff(f)G$f_m f_m(f_m)$KT	
$d_n d_n d_n V d_x d_x d_x$ VVVVVSM $RD_R D_R/V_R V_R V_R V_R$FT or	
$RD_R D_R/V_N V_N V_N V_N VV_X V_X V_X V_X$FT w'w' $N_S N_S N_S h_S h_S h_S$ or $VVh_S h_S h_S$ or	
SKC T'T'/$T'_d T'_d$ $AP_H P_H P_H P_H$ RMK SLPppp	
Supplemental Reporting Code	
Note: When a specific phenomenon does not occur, the group or group suffix is not reported.	

Wind

Wind is reported by the groups dddff(f)G$f_m f_m$(f_m)KT and $d_n d_n d_n$V$d_X d_X d_X$. The first wind data group includes reported true wind direction, wind speed, and wind character; the second group is used to report variable wind direction. While the wind direction and speed must be included in every METAR report even when the wind is calm, the wind character and wind direction variability are only reported when significant.

WIND SPEED, DIRECTION, AND CHARACTER.—dddffG$f_m f_m$KT. The true wind direction, *ddd*, is reported to the nearest 10 degrees, and may be encoded as *VRB* when wind speed is less than 6 knots. For example: Wind from 90° is reported "090." The *ff* is the 2-minute average wind speed in knots. If no gusts are reported, the identifier KT follows without a space. Calm winds are encoded "00000KT." Wind speeds exceeding 99 knots are reported in three figures. Gusts are only reported if winds exceed the average wind speed by 10 knots or greater. The *G* is the indicator for wind gusts, and $f_m f_m$ is the maximum gust speed observed during the last 10-minute period. Gusts exceeding 99 knots are also reported in three figures; for example, a wind from 270 at 25 knots with gusts to 40 knots would be encoded as 27025G40KT.

While *KT* is the indicator for wind speed (in knots) as used in the United States, wind speeds may be reported by other countries in kilometers per hour or in meters per second. *KMH* indicates wind speed in kilometers per hour, and *MPS* indicates wind speed in meters per second.

VARIABLE WIND DIRECTION GROUP.—dndndnVdxdxdx. The variable wind direction group is only reported if the winds vary by 60° or more and the winds are >6 knots. The dndndn is the "left" direction limit (in true [T] azimuth degrees), while the *V* is an indicator for "variable," and dxdxdx is the "right" limit. For example, if the winds are variable between 123°T and 191°T, the group would be encoded 120V190. Wind direction may also be reported as variable if the wind speed is less than 6 knots, for example, VRBO4KT.

Visibility Groups

The visibility groups, VVVVVSM, $RD_R D_R/V_R V_R V_R V_R$FT, or $RD_R D_R$ /$V_N V_N V_N V_N VV_X V_X V_X V_X$FT are used to report *horizontal surface visibility* and *runway visual range,* respectively.

HORIZONTAL SURFACE VISIBILITY.—VVVVVSM group is the minimum significant surface horizontal visibility and is reported by *VVVV* in statute miles (SM) with reportable increments, as described in chapter 1. This element is reported in *meters by* OCONUS stations.

RUNWAY VISUAL RANGE.—$RD_R D_R/V_R V_R V_R V_R$FT or $RD_R D_R$/ $V_N V_N V_N V_N VV_X V_X V_X V_X$FT. Runway visual range (RVR) is only reported when the RVR on any active runway is 6,000 feet or less or the visibility is less than 1 mile. Groups may be repeated as required for each runway. The *R* is the indicator for RVR, while $D_R D_R$ is the runway identifier, plus designator *L* (left), *C* (center), or *R* (right) as appropriate. The $V_R V_R V_R V_R$ is the average touchdown RVR during the 10-minute observation period, in hundreds of feet.

If the Runway visual range is variable, the second RVR group, $RD_R D_R/V_N V_N V_N V_N VV_X V_X V_X V_X$FT, is used in place of the first. To be considered variable, 1-minute average readings must differ by more than 50 meters or, more than 20% of the mean value during the 10-minute observation period. The lowest reportable 1-minute mean minimum and the highest reportable 1-minute mean maximum visual ranges, respectively, are reported during variable RVR conditions.

When an observed RVR is less than the RVR sensor's established accurate minimum reading, the minimum accurate reading is reported and preceded by the letter *M.* Example: The sensor reports a 40-meter visibility but the sensor's minimum limit is 50 meters; $V_R V_R V_R V_R$ is encoded M0050FT. Likewise, if the observed RVR is greater than the established accurate RVR-sensor maximum, then the sensor's accurate maximum reading is reported and preceded by the letter *P.* Again, OCONUS stations will report RVR using meters.

Present Weather Groups

This group is used to report present weather—w'w'. This group is only reported when significant weather is occurring at the station or in the vicinity (within 10 miles of the station) at the time of the observation.

The aviation present weather group may be used three times to include all significant weather. Each usage consists of from two to nine characters to describe present weather. Each group may contain, in order, an intensity symbol "+" for heavy or "-" for light (no intensity symbol means the precipitation is moderate) or the indicator *VC* for vicinity, a two-letter qualifier

(MI, PR, DR, BL, BC, SH, TS, or *FZ),* and a two-letter weather descriptor. When more than one type of precipitation is falling at the same time, up to 3 two-letter precipitation descriptors may be combined in the same group. Obscurations are normally only reported when the prevailing visibility is less than 7 miles. Note that no intensity qualifier may be coded with *VC.* Table 3-2 provides a list of METAR/SPECI code weather phenomena type entries.

REVIEW QUESTIONS

Q10. How many types of observations are in the METAR code?

Q11. What elements make up the identification section of a METAR observation?

Q12. How should a wind direction of 183° a wind speed of 105 knots, and gusts at 120 knots be encoded?

Q13. How should a variable wind of 090° to 150° at 15 knots be encoded?

Q14. What does the symbol VVVVVSM indicate?

Q15. How should the RVR information "left runway 02, visibility 1,000 feet, varying 3,000 feet" be encoded?

Q16. What does the symbol BR indicate?

Q17. How should heavy showers in the vicinity be encoded?

Q18. What does the symbol PO indicate?

Sky Coverage/Height Group

Either the group $N_SN_Sh_Sh_Sh_S$ is used up to three times to report cloud layer coverage and height or the group VVhshshs is used to report conditions when the sky is obscured. The abbreviation "SKC" is used when the sky is clear.

CLOUD COVERAGE / HEIGHT.— $N_SN_SN_Sh_Sh_Sh_S$. This group is used to report coverage of cloud layers or cloud masses, not specifically for individual cloud types. The summation principle is used to evaluate sky coverage in ascending order, as discussed in chapter 1. The same sky coverage abbreviations for $N_SN_SN_S$ are also used on the form; that is, *FEW* for 1/8 to 2/8 coverage, *SCT* for scattered (3/8 to 4/8), *BKN* for broken (5/8 to 7/8), and *OVC* for overcast (8/8). The cloud base height, $h_Sh_Sh_S$, is encoded in hundreds of feet, as discussed in chapter 1. At mountain stations, if the layer is below station level, the height of the layer will be coded as ///.

This group may be used six times for masses of clouds at six different levels. When CB or TCU clouds are observed, the cloud abbreviation is added to the end of the group, as in "BKN035CB." Stations overseas are

Table 3-2.—METAR/SPECI Code Weather Phenomena Type Entries

QUALIFIER		WEATHER PHENOMENA		
Intensity or Proximity	Descriptor	Precipitation	Obscuration	Other
1	2	3	4	5
- Light	MI Shallow	DZ Drizzle	BR Mist	PO Well-dvlpd
Moderate	PR Partial	RA Rain	FG Fog	Dust/Sand
+ Heavy	BC Patches	SN Snow	FU Smoke	Whirls
VC Vicinity	DR Low Drifting	SG Snow Grains	VA Volcanic Ash	SQ Squalls
	BL Blowing	IC Ice Crystals	DU Widespread	FC Funnel Cloud
	SH Shower(s)	PE Ice Pellets	Dust	Tornado
	TS Thunderstorm	GR Hail	SA Sand	Waterspout
	FZ Freezing	GS Small Hail	HZ Haze	SS Sandstorm
		and/or Ice	PY Spray	DS Duststorm
		Pellets		

NOTE: The weather groups are constructed by considering columns 1 to 5 in the table above in sequence, i.e., intensity followed by description, followed by weather phenomena. Example, heavy rainshower(s) is coded as **+SHRA.**

restricted to three reportable layers except when CB or TCU are present, in which case a fourth layer may be used.

SURFACE-BASED OBSCURATIONS.—Surface-based obscurations will also use $N_SN_SN_Sh_Sh_Sh_S$ group. However, $h_Sh_Sh_S$ will be encoded as 000 for heights of less than 50 feet. Stations overseas will encode 000 as ///.

When the sky is totally obscured, the VVhshshs group is used in place of the NsNsNshshshs group, with Wthe indicator for an indefinite ceiling, and $h_Sh_Sh_S$ the vertical visibility into the ceiling.

CAVOK STATEMENT.—In many countries, a statement for Ceiling And Visibility O.K. (CAVOK) may be substituted for the visibility, weather, and sky coverage when (1) the visibility is 10 km or greater, (2) there are no clouds below 5,000 feet (1,500 m) and no CB clouds, and (3) there is no significant weather occurring. This statement is NOT acceptable for use by Navy and Marine Corps activities.

Temperature

The temperature and dew-point temperature group $T'T'/T'_dT'_d$ is always included in a METAR observation report. T'T' is the temperature rounded up to the nearest whole degree Celsius, while $T'_dT'_d$ is the dew-point temperature rounded up to the nearest whole degree Celsius. Prefix single-digit temperatures with a zero. Negative temperatures are preceded by an *M*. For example, -9°C is encoded M09. If the temperature is not available, omit the entire group. If only the dew point is not available, use a single solidus after the temperature (10/).

Altimeter Setting

The altimeter setting group $AP_HP_HP_HP_H$ is always included in a METAR observation report. The altimeter setting following the *A* indicator is reported in inches of mercury rounded to the nearest hundredth of an inch. Do not use a decimal point. For example, an altimeter setting of 29.242 inches is encoded A2924.

REMARKS AND ADDITIVE DATA

In addition to the regularly reported data identified in table 3-1, the METAR code may also contain many remarks. Some of the remarks are required at different scheduled observation times, while others are required to provide amplification for certain significant meteorological events. Some remarks may be in the format of coded data groups (known as *additive data groups* and *supplemental data groups*), or as abbreviated plain language. NAVMETOCCOMINST 3141.2 and NAVMETOCCOMINST 3144.1 provide general guidance for plain language remarks and the proper abbreviations to use. FAA Order 7340.1, *Contractions,* contains a word-to-contraction encoding and contraction-to-word decoding listing for all allowable contractions. See table 3-3 for a listing of reportable remarks.

Table 3-3.—METAR and SPECI Code Remarks

REMARKS (RMK)		
Element	METAR	SPECI
Volcanic Eruptions	X	X
Tornadic Activity	X	X
Type of Station	X	X
Peak Wind	X	
Wind Shift, FROPA	X	X
Tower Visibility	X	X
Variable Prevailing Visibility	X	X
Sector Visibility	X	X
Lightning	X	X
Beginning/Ending of Thunderstorms and/or Precipitation	X	X
Thunderstorm Location	X	X
Hailstone Size	X	X
Virga	X	X
Variable Ceiling	X	X
Obscuration(s)	X	X
Variable Sky Condition	X	X
Significant Cloud Types	X	X
Pressure Rising/Falling Rapidly	X	X
Sea Level Pressure	X	X
Aircraft Mishap	X	X
No SPECI Taken	X	
Snow Increasing Rapidly	X	
Runway Condition	X	X
Breaks or Thin Spots in Overcast	X	X
First and Last Remark	X	X
X indicates element included at all stations		

All remarks and additive data groups used in an METAR coded observation must be indicated by the abbreviation "RMK" and should be in the order listed in table 3-3. Some general comments on certain remarks appear below.

SEA LEVEL PRESSURE (SLPppp). This remark is MANDATORY. Sea level pressure is encoded as SLPppp where SLP is the remark identifier and ppp is the sea-level pressure coded by using the tens, units, and tenths digits in hectopascals. For example, a sea level pressure of 998.2 hectopascals would be encoded as "SLP982." If sea level pressure is not available, it is coded as "SLPNO."

AIRCRAFT MISHAP (ACFT MSHP). If a report is taken to document weather conditions when notified of an aircraft mishap, the remark ACFT MSHP will be included on the observation form but will not be transmitted.

Table 3-4.—Additive Data Groups

Additive Data (RMK)		
Element	**METAR**	**SPECI**
Hourly Precipitation Amount	X	
3- and 6-hourly Precipitation Amount	X	
24-hour Precipitation Amount	X	
Snow Depth on the Ground, 4/sss	X	
Water Equivalent of Snow on the ground, 933RRR	X	
Cloud Types $8/C_LC_MC_H$	X	
Hourly Temperature and Dew Point	X	
6-Hourly Maximum Temperature	X	
6-Hourly Minimum Temperature	X	
24-Hour Maximum and Minimum Temperature	X	
3-Hour Pressure Tendency 5appp	X	
X indicates element included at all stations		

FIRST and LAST (FIRST and LAST). At part-time stations, the first and last reports transmitted will be identified by including the word "FIRST" in the report of the day after a break in observing coverage and/or the word "LAST" in the last report of the day before a break in observation coverage.

Additive Data Groups

Additive data consists of supplementary precipitation, temperature, cloud, and pressure information reported hourly, every 3 hours or every 6 hours. At 0300Z, 0900Z, 1500Z, and 2100Z, the 3-hourly additive data is included in observation reports. At 0000Z, 0600Z, 1200Z, and 1800Z, the 6-hourly additive data is included in the observation reports.

The 3-hourly additive data consists of the 3-hour pressure tendency, cloud type information, and precipitation data reported in the symbolic format shown in table 3-4. The 6-hourly additive data shown in this table is identical except it contains 6-hour precipitation data.

Other supplementary information consists of snow depth, maximum or minimum temperature, and 24-hour precipitation. The snow depth group is reported (in inches) only if there is snow or frozen precipitation on the ground. It is normally reported in the OOOOZ and 1200Z observations, and at subsequent 6-hourly observations (18002, OOOOZ, 06002) if measurable precipitation has occurred during those periods. The maximum and minimum temperatures during the past 6 hours are reported at 0000Z, 0600Z, 1200Z, and 1800Z, while maximum and minimum temperatures during the past 24 hours are reported at 0600Z. The 24-hour precipitation (liquid equivalent) is reported only at 1200Z. If a station is closed down for a weekend or holiday, the 24-hour precipitation should also be used to report total precipitation since the last reported 24-hour precipitation In this case, the 24-hour precipitation may actually be used to report a 72-hour total precipitation.

Runway Conditions

Runway surface condition (RSC) and average runway condition reading (RCR) are included in a METAR coded report when runway conditions produce less than normal braking for landing aircraft. Different codes may be combined to describe conditions. Each condition should be followed by a decelerometer reading (RCR) from 02, poor braking action, to 25, excellent braking action. Codes used for RSC include "WR" for wet runway, "SLR" for slush on runway,

"LSR" for loose snow on runway, "PSR" for packed snow on runway, and "IR" for ice on runway. The code "RCRNR" is used when braking action is impeded but accurate decelerometer readings are not available. For example, a runway with packed snow and a decelerometer reading of 15 would be reported as PSR15.

NAVMETOCCOMINST 3141.2 contains many additional examples of runway condition reports, including descriptive terms used when a decelerometer is not available.

Regional Differences

Specific data that may be included in the supplemental data section within each WMO region are normally described in WMO Publication 306, Manual on Codes, Volume II, *Regional Codes and Coding Practices.* Within WMO Region IV, North America, at the time of this writing, no decisions have been made on regional additions to the METAR code.

SPECI CODE OBSERVATION REPORTS

The SPECI code is used to report any significant changes in the weather at any time other than the scheduled hourly observation. Both NAVMETOCCOMINST 3141.2 and NAVMETOCCOMINST 3144.1 outline criteria and requirements for special observations that are reported using the SPECI code. The SPECI code uses the same groups in the same order as reported in the METAR code except that for a special observation, SPECI replaces METAR. The time reported in a SPECI report is the time that the change was observed to have occurred, not the time that the report is transmitted.

REVIEW QUESTIONS

Q19. How should scattered cumulonimbus at 2,500 feet be encoded?

Q20. How should a surface-based partial obscuration (3/8) of fog be encoded?

Q21. In what situation is the group $VVh_Sh_Sh_S$ used?

Q22. How should an air temperature of -4.4°C be encoded?

Q23. What remark in the METAR code is mandatory for all observations?

Q24. What does the additive data group 4/006 indicate?

Q25. The total 24-hour precipitation is reported at what time?

Q26. What does the additive data remark SLR12 indicate?

Q27. What publications contain criteria and requirements for SPECI observation?

SHIPBOARD SURFACE AVIATION WEATHER—SHIP AVIATION CODE

LEARNING OBJECTIVES: Identify the manuals that provide instructions for recording weather elements on the U.S. Ship Aviation Code observation form. Identify the applications of the U.S. Ship Aviation Code observation form. List the weather elements required on the U.S. Ship Aviation Code form and describe how the elements are entered and encoded.

Shipboard weather observers use CNMOC Form 3141/3 to record weather observation data in the METAR/SPECI code. Unlike shore sites, the METAR code aboard ship is used only to record data, not to encode data for transmission. For transmission to data collection centers, these observations are encoded into WMO Code FM 13-XI, the ship synoptic code, normally transmitted every 6 hours. The bottom portion of CNMOC Form 3141/3 is used to record the encoded synoptic observations. We will discuss the Ship Synoptic code later in this chapter. In this section, we briefly cover how the data is recorded on the form.

The shipboard observation form (fig. 3-2) is very similar to the shore station METAR code form. While some columns for recording weather elements at sea are the same as those used ashore, the elements that are unique to observations at sea are designated with letters. Additionally, all columns are identified with the type of data to enter, and, in many cases, with the system of measurement and the degree of precision required.

NAVMETOCCOMINST 3144.1, *Manual for Ship's Surface Weather Observations,* provides detailed instructions for recording observed weather elements on the form. Remarks that apply to aircraft operations are entered in column 14. Remarks are generally entered in the same order that the basic coded information is entered.

The additive data, supplemental data, remarks about RVR, and runway conditions as used in the METAR/SPECI code at shore stations are NOT used by shipboard observers.

REVIEW QUESTIONS

Q28. What column on CNMOC Form 3141/3 is used to record remarks?

Q29. What column is used to record sea surface temperature?

Q30. What column is used to recordsea wave height?

Q31. What publication provides detailed instructions for taking and recording ship observations aboard U.S. Navy ships?

SYNOPTIC CODES

LEARNING OBJECTIVES: Identify the manuals that provide instruction on encoding and decoding land and ship synoptic observations. Explain the meaning of each code figure in the land and ship synoptic code. Describe the code used to relay reports from moored coastal observation buoys.

Where the METAR/SPECI codes are designed to report aviation weather, the Synoptic code is specifically designed to include data for use in analyzing the current overall weather situation. It is a numerical code that consists mostly of groups of five digits, specifically designed. to permit automatic loading of computer data bases.

The Synoptic reports are transmitted by selected stations worldwide at 0000Z, 0600Z, 1200Z, and 1800Z—the "Synoptic Hours"—with the reports generally called "Main Synoptic" reports. Significant reports called "Intermediate Synoptic" reports may be transmitted at the "Intermediate Synoptic" hours: 0300Z, 0900Z, 1500Z, and 2100Z.

Although the Synoptic code transmitted by land stations and by ships report many of the same weather elements by using the same symbolic groups, there are some differences in the way the station is identified. There are also different types of data that are only reported by land stations, just as there is some data that is only reported by ships.

The primary reference manual used to encode weather elements observed during an aviation hourly weather observation at land stations into land Synoptic codes is the Federal Meteorological Handbook No. 2 (FMH-2), *Surface Synoptic Codes.* This publication describes which elements are encoded, and also covers supplemental data, which is added to the International code form as Regional data in WMO Region IV — North America, (and U.S. stations in WMO Region V — Central and Southern Pacific, including Hawaii, Guam, and the Philippines). It also includes National Data, which is added to the code in the United States.

The primary reference used when encoding weather observations into the ship Synoptic code is NAVMETOCCOMINST 3144.1, *United States Nary Manual for Ship'.s Surface Weather Observations,* although the FMH-2 also provides guidance on the ship Synoptic code. The publications that are most useful in decoding Synoptic reports received from overseas stations are the WMO Publication 306, Manual on Codes, Volume 1, *International Codes,* and Volume 2, *Regional Codes and National Coding Practices. The International Codes* provides symbolic formats for all of the International codes, an alphabetical listing of each symbolic element, with an explanation of each code element and reference to the appropriate code table, as well as a section providing all of the WMO code tables.

In the following text, we discuss the land Synoptic code, the ship Synoptic code, and the code used to relay reports from moored coastal observation buoys. Most of the applicable code tables are listed in Appendix IV. First, let's consider the land Synoptic code.

LAND SYNOPTIC CODE

In addition to reporting surface aviation hourly observations, many Navy and Marine Corps land stations, both in the United States and overseas, also report Synoptic weather observations in WMO Code FM 12-XI SYNOP.

Table 3-5 provides a breakdown of the symbolic code format of the land Synoptic code. Only those groups considered significant are included in a report. If the type of data the code group requires is not normally available at a station, the entire group is not reported. A solidi (forward-slash /) is used in place of each number that is normally reported, but is unobservable because of weather conditions or equipment failure.

Table 3-5.—Symbolic Format of Land Station Synoptic Weather Observation Report (WMO Code FM 12 XI SYNOP)

AAXX YYGGi_w IIiii $i_R i_X$h Nddff (00fff) ls_nTTT $2s_nT_dT_dT_d$ $3P_OP_OP_OP_O$ 4PPPP (or $4a_3$hhh) 5appp $6RRRt_R$ $7wwW_1W_2$ $8N_hC_LC_MC_H$ 9GGgg 333 0. . . . $ls_nT_XT_XT_X$ $2s_nT_nT_nT_n$ 3Ejjj 4E'sss $5j_1j_2j_3j_4$ ($j_5j_6j_7j_8j_9$) $6RRRt_R$ $7R_{24}R_{24}R_{24}R_{24}$ $8N_sCh_sh_s$ $9S_PS_PS_{p}S_P$ 444 N'C'H'H'C_t 555;

Identification Data

The first few groups of the Synoptic code represent Section 0, the Identification Data section. The Identification Data section contains a data identifier, a date-time group, and a station identifier.

DATA IDENTIFIER.—The data identifier for a land synoptic report is the first group, which is always AAXX.

DATE-TIME GROUP.—YYGGi_W. This group provides the day of the month and the hour of the report, as well as an indicator for the wind speed. *YY* is the UTC day of the month (two digits), *GG* is the UTC hour of report (00, 03, 06, etc.), and i_W is the indicator for source and units of wind speed (WMO code table 1855).

STATION IDENTIFIER.—IIiii. The station identifier is composed of the WMO block number and the three-digit station number. *II* is the WMO block number, and *iii* is the WMO station number. Each WMO region is subdivided into data block areas. Large countries may be designated as a data block, or several smaller, adjoining countries may be grouped together to form a block. In North America the United States is block 72, with supplemental stations belonging to block 74. Alaska is block 70. Canada is block 71; Mexico is block 76; and all the countries of the Caribbean and Central America are grouped as block 78.

International Data

Section 1 of the Synoptic code contains meteorological data for international exchange, and immediately follows the identification data. This section consists of cloud height and visibility, winds, sky coverage, air temperature, dew-point temperature, station pressure and sea-level pressure, pressure change, precipitation, and weather groups. In North America (WMO Region IV), it also contains a group for cloud type. Most of the five-digit groups begin with a group identifier number that does not change.

CLOUD HEIGHT/VISIBILITY.—$i_R i_X$hVV. The i_R is the precipitation data (group $6RRRt_R$) indicator (WMO code table 1819), while i_X is the indicator for station type (manned or unmanned) and for present and past weather (group $7wwW_1W_2$) (WMO code table 1860). The *h* is height (AGL) of lowest cloud (WMO code table 1600), and *VV* is horizontal surface visibility (WMO code table 4377).

SKY COVERAGE/WIND.—Nddff. The *N* is total sky cover in eighths or oktas (WMO code table 2700), while *dd* is the wind direction (hundreds and tens of degrees true) to the nearest 10 degrees, and *ff* is the sustained wind speed in the units indicated by i_W. If winds exceed 99 (knots or meters per second), *ff* is encoded 99 and the *00fff* group is included, with 00 as an indicator and *fff* as the wind speed in hundreds, tens, and units.

AIR TEMPERATURE.—$1s_nTTT$. The s_n is the temperature sign, 0 for positive (or 0) and 1 for negative. This indicator is used throughout the Synoptic code to indicate the temperature sign. The *TTT* is the temperature in tens, units, and tenths of a degree Celsius.

DEW-POINT TEMPERATURE.—$2s_nT_dT_dT_d$ The $T_dT_dT_d$ is the dew-point temperature in tens, units, and tenths of a degree Celsius.

STATION PRESSURE.—$3P_OP_OP_OP_O$. The $P_OP_OP_OP_O$ is the station pressure in hundreds, tens, units, and tenths of hPa (thousands value omitted).

SEA-LEVEL PRESSURE—4PPPP. The PPPP is the sea-level pressure in hundreds, tens, units, and tenths of hPa (thousands value omitted).

STANDARD LEVEL HEIGHT.—$4a_3$hhh. Reported by mountain stations in place of sea-level pressure, a_3 is the standard isobaric surface reported (WMO code table 0264) and *hhh* is the geopotential height in meters, omitting thousands value.

3-HOUR PRESSURE CHANGE.—5appp. The *a* is the pressure tendency (WMO code table 0200), and *ppp* is the 3-hour pressure change in tens, units, and tenths of hPa.

PRECIPITATION TOTAL.—6RRRt_R. The *RRR* is the liquid equivalent of the precipitation amount reported in hundreds, tens and units of millimeters (exception: 990 is a trace, and codes 991 to 999 are used to report tenths of a millimeter total precipitation from 0.1 to 0.9 respectively). And t_R is the duration of the reference period ending at the reporting time (WMO code table 4019). Precipitation amounts observed in inches may be converted to millimeters by multiplying 25.4 mm/inch. In WMO Regions IV and V, this group is normally used to report 6-hour precipitation at each synoptic observation with t_R encoded 1, except the 0000Z report from U.S. stations in Region V reports 24-hour precipitation with TV encoded 4.

WEATHER.—7wwW$_1$W$_2$. The *ww* is the present weather code (WMO code table 4677), and W$_1$ and W$_2$ are past weather codes (WMO code table 4561). See appendix IV.

PREDOMINANT CLOUD TYPE.—8N$_h$C$_L$C$_M$C$_H$. The N_h is the summation coverage of all low etage clouds present, or, if no low clouds are present, the summation of all the mid-etage cloud coverage, in oktas of the sky covered (WMO code table 2700). C$_L$ is the predominant low-etage cloud type (WMO code table 0513). C$_M$ is the predominant mid-etage cloud type (WMO code table 0515). And C$_H$ is the predominant high-etage cloud type (WMO code table 0509).

OBSERVATION TIME.—9GGgg. This group is only encoded when the actual observation time (time the last element in the observation was observed) differs from the standard observation time (the synoptic or intermediate synoptic hour) by 10 minutes or more. The *GG* is the UTC hour, while the *gg* is the minutes of the actual observation time.

REVIEW QUESTIONS

Q32. What is the purpose of the Synoptic code?

Q33. What are the intermediate synoptic hours?

Q34. What is the primary reference manual used for encoding land synoptic observations in the United States?

Q35. What groups are included in the identification section of a land synoptic observation?

Q36. How would $i_R i_X$hVV be encoded for a manned station with no precipitation or significant weather in the past 6 hours, a low overcast cloud deck at 3,500 feet, and visibility at 7 miles?

Q37. How would a station with 6/8 total sky coverage and a wind direction of 240° and a wind speed of 103 knots be encoded?

Q38. What do the sections $1S_nTTT$ and $2S_nT_dT_dT_d$ indicate?

Q39. What do the sections $3P_OP_OP_OP_O$ and 4PPPP indicate?

Q40. If the station pressure at 0300Z was 1020.6 hPa, then increased to a high of 1021.5 hPa at 0400Z, and is now 1019.8 hPa at 0600Z, how should the group 5appp be encoded?

Q41. If a station received 1.2 mm of precipitation between 0000Z and 0600Z, how should 6RRRt_r be encoded?

Q42. If a station had heavy snow showers at the time of observation and rain showers and overcast conditions in the previous 2 hours, how should the group $7wwW_1W_2$ be encoded?

Q43. If a station has no low clouds, 2/8 altocumulus castellanus, 3/8 thin altostratus, and 3/8 cirrostratus not covering the whole sky and not invading the celestial dome, how should the group $8N_hC_LC_H$ be encoded?

Regional Data Section

The regional data section, following the group 333, includes both internationally established codes and codes unique to each region.

WMO REGION IV STATE OF THE SKY IN THE TROPICS.—0C$_S$D$_L$D$_M$D$_H$. The C_S is the cloud state from FMH-2, table 6-4; while D_L, D_M, and D_H are the direction from which the low-, mid-, and high-etage clouds, respectively, are moving (using the 8-point compass, 1 = NE, 2 = E, and so forth; 0 is no movement, and 9 is unknown). This group is only reported by stations in the southern portion of WMO Region IV within 310 statute miles of the seacoast during the tropical season.

MAXIMUM TEMPERATURE.—1s$_n$T$_X$T$_X$T$_X$. The T$_X$T$_X$T$_X$ is the maximum temperature in tens, units and tenths of a degree Celsius. The time period is specified by regional agreement; see table 3-6 for WMO Region IV and V conventions.

MINIMUM TEMPERATURE.—2s$_n$T$_n$T$_n$T$_n$. The T$_n$T$_n$T$_n$ is the minimum temperature in tens, units, and tenths of a degree Celsius.

Table 3-6.—Synoptic Reporting Times for Maximum and Minimum Temperatures for U.S. Stations in WMO Regions IV and V

REPORT	WMO REGION	REPORTED INFORMATION
0000Z	IV only	$T_XT_XT_X$for past 12 hours and $T_nT_nT_n$ for past 18 hours.
	V only	$T_nT_nT_n$ for past 24 hours.
0600Z	IV only	$T_XT_XT_X$ for past 24 hours and $T_nT_nT_n$ for past 24 hours.
1200Z	IV only	$T_XT_XT_X$ for previous calendar day ending 2400 LST, and $T_nT_nT_n$ for past 12 hours .
	V only	$T_XT_XT_X$ past 24 hours.
1800Z	IV only	$T_XT_XT_X$ for past 12 hours and $T_nT_nT_n$ for past 18 hours .

STATE OF THE GROUND WITHOUT SNOW OR ICE.—3Ejjj. The *E* is the state of the ground (WMO code table 0901), and *jjj* is regional information. (Group is not reported in WMO Region IV.)

SNOW OR ICE ON THE GROUND.—4E'sss. The *E'* is state of snow or ice covering the ground (WMO code table 0975) and is reported in WMO Region IV as /. The *sss* is the average snow/ice depth in hundreds, tens, and units of centimeters.

SUPPLEMENTARY INFORMATION.—$5j_1j_2j_3j_4$. The j_1 is the information designator (WMO code table 2061), while $j_2j_3j_4$ and, if necessary, the following group, $j_5j_6j_7j_8j_9$, contains the coded information.

Cloud Movement.—$56j_2j_3j_4$. In WMO Region V, U.S. stations use this group to report cloud movement pertaining to the clouds reported in the 8NhCLCMCH group for the low-, mid-, and high-etage clouds, respectively, and is not reported in Region IV.

24-Hour Pressure Tendency.—The $58p_{24}p_{24}p_{24}$ group is used to report a net increase or no net change in the 24-hour pressure tendency in tens, units and tenths of hPa. The $59p_{24}p_{24}p_{24}$ group is used to report a net decrease in the 24-hour pressure tendency. The 24-hour tendency is reported only in each of the main synoptic reports in the southern part of Region IV instead of the 5appp group in section 1. In Region V, U.S. stations report the 5appp group but additionally report the 24-hour tendency at 0000Z and 1200Z.

PRECIPITATION TOTAL.—$6RRRt_R$ If this group is not previously reported in section 1, some regions report this group in the supplemental data section.

24-HOUR PRECIPITATION.—$7R_{24}R_{24}R_{24}R_{24}$. This group is included in all synoptic reports in Region IV unless no precipitation was received. The $R_{24}R_{24}R_{24}R_{24}$ is the 24-hour total liquid equivalent precipitation in hundreds, tens, units, and tenths of millimeters. A trace (<0.005 inch or <0.05 millimeter) is encoded 9999.

CLOUD LAYER DATA.—$8N_SCh_Sh_S$. This group reports the amount, predominant type, and height of cloud in a layer, and may be used four times to report four individual layers. The N_S is the amount of cloud in oktas, the C is the predominant cloud type (WMO code table 0500), and h_Sh_S is the height of the cloud base (WMO code table 1677). This group is used by select stations in WMO Region IV.

SPECIAL INFORMATION.—$9S_pS_pS_pS_p$. This group may be used to report special information in the International code, as selected by regional decision. The S_pS_p indicates the type of data (WMO code table 3778) while the s_ps_p is the specific data. This group is not generally used in Region IV or by U.S. stations in Region V.

Regional Mountain Station Data

Indicated by the group 444, section 4 of the report contains information generally reporting clouds with bases below the station level (mountain stations). All data other than N'C'H'H'C_t is in regionally decided code. The International code N'C'H'H'C_t is described by WMO code tables 2700, 0500, and 0552 for N', C', and C_t, with *H'H'* the top of the cloud mass in hundreds of meters. It is not generally in use in Region IV or by U.S. stations in Region V.

National Code Groups

All data in section 5 after the 555 indicator is in National code forms. In WMO Region IV, U.S. National Weather Service stations report certain information in this section on record temperatures, coastal tides, and coastal or lake water temperatures. The specific codes used are contained in FMH-2. Navy and Marine Corps stations do not use these codes. Canada and Mexico report different national codes, as may each country in Region V. Now let's look at the ship synoptic code.

REVIEW QUESTIONS

Q44. What information follows the 333 indicator group?

Q45. When should the 24-hour maximum and minimum temperatures be reported in WMO region IV?

Q46. When is the 58$p_{24}p_{24}p_{24}$ group used?

Q47. What information follows the 555 indicator group?

SHIP SYNOPTIC CODE

The ship Synoptic code (WMO code FM 13-XI SHIP) is used aboard U.S. Naval ships to report weather as observed and recorded in the METAR/SPECI code. The ship synoptic report is encoded on the bottom portion of the ship observation form. Internationally, the code is used to disseminate meteorological data from nearly all ships that observe weather conditions.

Table 3-7 shows the symbolic format of the ship Synoptic code. Many of the data groups are the same as the land Synoptic code, especially in data section 1. The ship Synoptic code uses different environmental data in data section 2, "Maritime Data," not generally used by shore stations. While some countries may use selected groups from data section 3 as identified in the land synoptic report, U.S. Naval vessels currently do not carry the equipment required to take the appropriate measurements, and likewise, do not report total precipitation (6RRRt_R).

Identification Data

The identification data in the ship Synoptic code contains the message type identifier *BBXX*, the ship's International Radio Call Sign, the date-time group, and the latitude and longitude of the ship.

INTERNATIONAL RADIO CALL SIGN.—DDDD. The ship's four-letter International Radio Call Sign (IRCS) is used as identification for the station. Converting the IRCS to the ship's name and country of registration may be done by using Allied Communication Publication 100 (ACP-100), *Allied Call Sign and Address Group System - Instructions and Assignments.* The group may consist of as few as three or as many as six letters or letter-number combinations, or may use the word *SHIP* for any ship, or *RIGG* for a stationary (oil) platform.

DATE-TIME GROUP.—YYGGi_W. Same as for land Synoptic code.

LATITUDE/LONGITUDE.—99$L_aL_aL_a$ and $Q_CL_OL_OL_OL_O$. The 99 is an indicator for latitude, and $L_aL_aL_a$ is the latitude in degrees and tenths of a degree (the minutes divided by 60 yields tenths of a degree). The first value in the longitude group, Q_C, is the quadrant of the globe (WMO code table 3333). (In relation to the equator and the prime meridian, quadrant 1 is north and east, 3 is south and east, 5 is south and west, and 7 is north and west.) And $L_OL_OL_OL_O$ is the hundreds, tens, units, and tenths of degrees longitude.

International Data Section

All of the data in the International Data Section, Section 1 of the code, is exactly the same as the land Synoptic code. However, since most ships do not carry rain-measuring equipment, the rainfall group, 6RRRt_R, is normally omitted from reports, and the associated indicator, i_R, is reported as 4.

Table 3-7.—Symbolic Format of Ship Synoptic Weather Observation Report (WMO Code FM 13-XI SHIP)

BBXX DDDD YYGGi_W 99$L_aL_aL_a$ $Q_CL_OL_OL_OL_O$ i_Ri_XhVV Nddff (00fff) 1s_nTTT 2s_nTdTdTd
4PPPP 5appp (6RRRt_R) 7wwW$_1$W$_2$ 8$N_hC_LC_MC_H$ 9GGgg 222D_Sv_S 0$s_ST_WT_WT_W$
(1$P_{wa}P_{wa}H_{wa}H_{wa}$) 2$P_WP_WH_WH_W$ 3$d_{w1}d_{w1}d_{w2}d_{w2}$ 4$P_{w1}P_{w1}H_{w1}H_{w1}$ 5$P_{w2}P_{w2}H_{w2}H_{w2}$ (70$H_{wa}H_{wa)}H_{wa}$) 6$I_sE_sE_sR_s$
8$s_wT_bT_bT_b$ ICE $c_iS_ib_iD_iz_i$ (or plain language);

Maritime Data Section

The Maritime Data Section, or Section 2 of the code, follows the indicator 222, the first three digits in the 222Dsvs group. This section is normally not transmitted from land stations, since it contains course and speed of the ship, sea-surface temperature, sea and swell wave information, ice accretion information, and information on sea ice.

SHIP'S COURSE AND SPEED.—$222D_Sv_S$. The D_S is the direction of displacement of the ship from 3 hours before the report indicated using WMO code table 0700 (0 is no displacement, 1 is toward the northeast, 2 is toward the east, etc.). The v_S indicates the speed "made good" from 3 hours before the observation until the observation time (in 5-knot increments) using WMO code table 4451. For example, a ship may move in a large circle at 10 knots, ending up at report time at the same location it was 3 hours previous. The D_S would be encoded as 0 for "no net displacement," and v_S would be encoded as 0 for "no speed made good." A second ship may follow an erratic course, ending up at report time 2 1 nautical miles southeast of the position 3 hours previous. The D_S is encoded as 3 for southeast displacement, and the v_S is encoded as 2 for speed made good "6 to 10 knots" (21 nautical miles divided by 3 hours equals 7 knots).

SEA - SURFACE TEMPERATURE.—$0s_sT_WT_WT_W$. The code symbol s_s is the temperature sign for seawater, which is followed by the sea-surface temperature in tens, units, and tenths of degrees Celsius as $T_WT_WT_W$.

SEA WAVES.—$2P_wP_wH_wH_w$. The period of the sea waves, as determined by an observer, is reported as P_wP_W in tens and units of seconds. The height of the sea waves is reported in one-half meter units in H_wH_w. Convert observed height in feet to half-meter units by multiplying by 0.61 and rounding off. When decoding, half-meter units may be converted to feet by multiplying by 1.64. A conversion table is available in NAVMETOCCOMINST 3144.1. Ships with automatic wave sensors and buoys with sensors use group $1P_{wa}P_{wa}H_{wa}H_{wa}$ in place of the "2" group. The $P_{wa}P_{wa}$ is the sensor-measured sea-wave period, and $H_{wa}H_{wa}$ is the sensor-measured sea-wave height in half-meter units.

S W E L L W A V E S.—$3d_{w1}d_{w1}d_{w2}d_{w2}$, $4P_{w1}P_{w1}H_{w1}H_{w1}$, and $5P_{w2}P_{w2}H_{w2}H_{w2}$, (or group $70H_{wa}H_{wa}H_{wa}$). Two significant swell waves may be reported.

Swell-Wave Direction.—Group 3 reports the primary swell wave direction in hundreds and tens of degrees as $d_{W1}d_{W1}$ and the secondary swell wave direction as $d_{W2}d_{W2}$. When no swell waves are observed, the group is encoded as 30000, and both the $4P_{W1}P_{W1}H_{W1}H_{W1}$ and $5P_{W2}P_{W2}H_{W2}H_{W2}$ groups are reported as 40000 and 50000. If only one swell wave is observed, the dw_2dw_2 is encoded as 00, and the $5P_{W2}P_{W2}H_{W2}H_{W2}$ group is reported as 50000.

Swell-Wave Period and Height.—The primary swell-wave period and primary swell-wave height are reported in group $4P_{W1}P_{W1}H_{W1}H_{W1}$. The secondary swell-wave period and height are reported in group $5P_{W2}P_{W2}H_{W2}H_{W2}$. The $P_{W1or2}P_{W1or2}$ is the swell-wave period in tens and units of seconds, while the $H_{W1or2}HW_{1or2}$ is the height of the swell waves in half-meter units.

Swell-Wave Height From Sensors.-Ships equipped with automatic wave-height-measuring equipment report the swell-wave height by using group $70H_{wa}H_{wa}H_{wa}$ in place of groups 3, 4, and 5. The $H_{wa}H_{wa}H_{wa}$ is the wave height in tens, units, and tenths of meters. Swell-wave direction and period from automatic sensors are normally not reported.

ICE ACCRETION.—$6I_SE_SE_SR_S$. The ice accretion group is only included in a report when ice accretion is occurring. The I_S is the source of the ice (WMO code table 1751); the E_SE_S is the thickness of the ice, in centimeters; and the R_S is the rate of accretion (or loss) (WMO code table 3551).

WET-BULB TEMPERATURE.—$8s_wT_bT_bT_b$. The wet-bulb temperature group is indicated by code figure 8. The s_w is the sign and type of the wet-bulb temperature (WMO code table 3855) and $T_bT_bT_b$ is the wet-bulb temperature in tens, units, and tenths of a degree Celsius.

SEA ICE.—ICE $c_iS_ib_iD_iz_i$. The sea ice group is only reported when ice is observed in the sea. "ICE" is the indicator that the sea ice group follows. The c_i is the concentration or arrangement of sea ice (WMO code table 0639), S_i is the stage of development (WMO code table 3739), b_i is ice of land origin (WMO code table 0439), D_i is the true bearing of the principal ice edge (WMO code table 0739) and z_i is the ice situation and trend over the past 3 hours (WMO code table 5239). In addition to the sea ice code, any remarks considered significant by the observer may be transmitted as plain language remarks.

Regional and National Groups

Regional information may be added to ship reports following a 333 indicator group, and National coded information may be added following a 555 indicator group. The 444 indicator group is NEVER used with ship reports. Although allowable, U.S. Navy vessels do not normally include any regional or national information in transmitted ship synoptic reports.

MOORED BUOY REPORTS

Moored meteorological/oceanographic (METOC) buoys are used throughout the world, primarily in areas critical to ship navigation. In the United States coastal waters, meteorological buoys are maintained by NOAA in the near coastal waters off major sea ports and harbors on the West Coast, East Coast, and Gulf Coast. Additional meteorological buoys are maintained in a network throughout the Gulf of Mexico, and in selected locations well off the East and West Coasts.

All moored buoys use the Synoptic code to report every 3 hours. They report Synoptic Code Section 0, Identification Data, and, depending on the sensors they contain, selected groups from Sections 1, 2, 3, and 5. The primary difference is in code Section 0, Identification Data. While the reports from buoys well off the coast use the ship Synoptic code "Section 0" with three-letter/number call signs and a latitude and longitude, the coastal buoys and Gulf of Mexico buoys use the land Synoptic code "Section 0" format with the station identification given in block (block 99) and station number, or a buoy number (such as "DB273" without latitude and longitude groups. These stations may be cross-referenced to latitude and longitude, as may any station referenced by block/station number by using the *Master Weather Station Catalog,* available via the Bulletin Board System (BBS).

REVIEW QUESTIONS

Q48. What is the message type identifier for the shipboard Synoptic code?

Q49. If a ship was located at 34.10N and 020.16E, how should this be encoded on a ship synoptic observation?

Q50. What does the indicator group 222 of the ship Synoptic code signify?

Q51. How should a ship speed made good of 12 knots with a displacement of 120" be encoded for $222D_Sv_S$*?*

Q52. If sea waves had a period of 5 seconds and a height of 4 feet, what should be encoded for $2P_WP_WH_WH_W$*?*

Q53. If the primary swell-wave direction is 040° with a height of 6 feet and a period of 8 seconds, and the secondary swell-wave direction is 170° with a height of 3 feet and a period of 12 seconds, how should this be encoded?

Q54. If ice accretion from ocean *spray is occurring at a rapid rate, and 1 centimeter has already accumulated, what should be encoded for the group* $6I_SE_SE_SR_S$*?*

Q55. What organization is responsible for maintaining METOC buoys off the coast of the United States?

SUMMARY

The codes discussed in this section are used to disseminate surface weather observations. The U.S. METAR/SPECI code and the international METAR/SPECI codes are primarily used to support aviation operations. The international Synoptic codes are used for general meteorological applications. Information from meteorological and oceanographic (METOC) buoys are also used to augment land and ship synoptic data.

ANSWERS TO REVIEW QUESTIONS

A1. World Meteorological Organization.

A2. Region IV

A3. METAR, SPECI Land Synoptic, Ship Synoptic.

A4. NAVMETOCCOMINST 3141.2.

A5. NAVMETOCCOMINST 3144.1.

A6. Annotate missing data with an "M, " and provide a brief explanation for missing data in Block 72 "Remarks, Notes, and Miscellaneous Data."

A7. Safety of aircraft, ships, and personnel.

A8. Line out the error, enter the correction in red, and annotate the time the corrected observation was transmitted.

A9. FNMOD, Asheville, North Carolina.

A10. There are two types of observations in the METAR code, METAR and SPECI.

A11. The observation type, the station identifier, the observation date/time, and if required, a report modifier.

A12. 180105G120KT.

A13. 12015KT 090V150.

A14. The surface visibility in statute miles.

A15. RO2L/1000V3000FT.

A16. Mist.

A17. VCSH.

A18. Well-developed dust/sand whirls.

A19. SCT025CB.

A20. SCTOOO.

A21. In the case of a total obscuration with an indefinite ceiling, with $h_sh_sh_s$ as the vertical visibility into the indefinite ceiling.

A22. M04.

A23. Sea-level pressure (SLPppp).

A24. Snow depth on ground of 6 inches.

A25. 1200Z.

A26. Slush on runway with a decelerometer reading of 12.

A27. Both NAVMETOCCOMINST 3141.2 or NAVMETOCCOMINST 3144.1

A28. Column 14.

A29. Column D.

A30 .Column E.

A31. NAVMETOCCOMINST 3144.1.

A32. The Synoptic code is designed to permit automatic loading of weather information to computer data bases for use in analysis and forecasting.

A33. 0300Z, 0900Z, 1500Z, and 2100Z.

A34. Federal Meteorological Handbook No. 2.

A35. Data identifier, date-time group, and station identifier.

A36. 32661.

A37. 62499 and 00103, respectively.

A38. Temperature and dewpoint in Celsius degrees.

A39. Station pressure and sea level pressure in hPa.

A40. 58008.

A41. 60011.

A42. 78682.

A43. 85088.

A44. Regional additive data.

A45. 06002.

A46. The $58_{p24p24p24}$ is used to report a net increase or no net change in the 24-hour pressure tendency.

A47. National additive data.

A48. BBXX.

A49. 99342 10203.

A50. Maritime data follows.

A51. 22233.

A52. 20502.

A53. 30417 40804 51202.

A54. 61012.

A55. NOAA.